Remarks In Response To The Outstanding Office Action

Claims 1-58 stand pending the present application without outstanding substantive rejection.

Claims 1-58 stand rejected under 35 USC. Section 112, second paragraph as being indefinite for allegedly failing to particularly point out and distinctly claim the subject matter which the applicant regards as the invention. More particularly, the Examiner is unclear as to what the Applicant intended by the claim phrase "admissibly transformed data" and the claim phrase "admissible geometrization."

The Examiner has required further clarification.

While applicant provides herewith a detailed treatment of the subject matter to be clarified, it will be understood that such is provided in clarification generally and shall not necessarily limit the subject matter claimed, the stated claims being that which defines the invention for Applicant seeks Letters Patent.

The claimed phrases "admissibly transformed data" and "admissible geometrization" may be understood in reference to or with an understanding of, the known term of art "admissible transformation" as taken from measurement theory, and specifically representational measurement theory (Narens, L., Theories of Meaningfulness. Lawrence Erlbaum, Mahwah, New Jersey, 2002; Stevens, S. S., "On the theory of scales of measurement," Science, 103, 1946, pp. 677–680).

In representational measurement theory, a measurement function or scale is defined to be a representation or homomorphism

$$f : \boldsymbol{E} \rightarrow \boldsymbol{N},$$

where $\boldsymbol{E}$ is a relational system modeling the measured empirical system, and $\boldsymbol{N}$ is a numerical relational system. (Commonly, $\boldsymbol{N}$ is a subset of the real numbers with the usual ordering and addition operation. See p. 6 of the Specification and references therein.)

Given relational systems $\boldsymbol{E}$ and $\boldsymbol{N}$, there may be more than one homomorphism or scale $f : \boldsymbol{E} \rightarrow \boldsymbol{N}$; that is, the measurement scale f may not be unique. In many important situations,

sets of scales can be classified into scale types defined by groups of functions called **admissible transformations**. Specifically, given scales $f, g : \boldsymbol{E} \to \boldsymbol{N}$, one says that f and g have the same scale type or measurement level if there exists an admissible transformation φ such that $f = \varphi \circ g$ (the right hand side denoting the composition of φ with g). In other words, the function φ transforms one admissible scale into another (Specification, p. 7). The following are five example scale types.

Scales whose only admissible transformation is the identity function are called absolute scale types. Examples are counts and probability frequencies.

Scales that are related by similarity transformations, that is, a change of unit, are called ratio scales (short for "scales of ratio scale type"). Length and weight (mass) are examples. One such admissible transformation for weight scales is $\varphi(x) = 2.2x$ converting kilograms to pounds.

Interval scale types are scales related by affine transformations which allow both a change of unit and zero point. The common temperature scales Fahrenheit and Celsius are interval scale types with $\varphi(x) = (9/5)x + 32$ the admissible affine transformation from Celsius to Fahrenheit scales.

Scales related by monotone transformations are called ordinal scale types. Mohs hardness scale for minerals is an ordinal scale as are various grading, ranking, and rating scales.

The nominal scale type is made up of representations that classify, name, or label objects. These scales are related by any one-to-one transformation or permutation.

Scale groups are ordered by inclusion; this induces an ordering on scale types. Stronger or higher scale types correspond to smaller (in the sense of inclusion) scale groups. Absolute scales are the strongest scale types with nominal scales the weakest (Specification p. 7).

In one embodiment of the invention, the claim phrase "admissible geometrization" refers to an iterative process whereby received data is embedded in a metric space—e.g., geometrized or made geometric—so that the received data corresponds to distances between a configuration of points in the target embedding space. The correspondence between received data and embedding

distances is mediated by admissible transformations (e.g., as defined above) so that embedding distances correspond to admissibly transformed received data. The phrase "admissible geometrization" references these two aspects of the claimed invention.

Distances are generally ratio scales, hence the correspondence between received data and embedding distances produced by admissible geometrization can be interpreted as scaling or conversion of the scale types of the received data into ratio scale types. Because a rigid metric space embedding may not exist, in one embodiment of the claimed invention admissible geometrization can be interpreted as approximating received data by ratio scales. More precisely, through the claimed process of admissible geometrization received data is admissibly transformed so as to approximately correspond to ratio scale configuration distances.

The claim phrase "admissibly transformed data" refers to an output of admissible geometrization. Said output includes admissibly transformed received data corresponding to distances between points in a target embedding space. In one embodiment of the invention, the claim phrase "admissibly transformed data" refers to admissibly transformed received data that approximates inter-point distances from a configuration of points in a Euclidean space.

In an embodiment of the invention, the claim phrase "admissibly transformed data" refers to an output of 2-phase individual differences multidimensional scaling (Specification, p. 13). In 2-phase individual differences multidimensional scaling, admissibly transformed received data approximates inter-point distances in a configuration of points in a Euclidean space through iterative minimization of a constrained 2-phase energy functional E_p (Specification, p. 10, equations 2 and 3).

Admissible geometrization as described in one embodiment of the invention treats data as potentially or implicitly geometric (Specification, pp. 5-6 and 9-10). Received data are interpreted as possibly mixed scale-type edge weights or edge 'lengths' on complete graphs (Specification, pp. 5-6). (These weighted graphs can be more picturesquely viewed as virtual drive tables with received data defining possibly mixed scale-type 'distances' between virtual cities.) The embedding step of admissible geometrization actualizes the potential geometry of the received data by representing the weighted graphs as configurations of points in a target metric space. (This aspect of admissible geometrization can be interpreted as constructing a map of virtual cities corresponding to a drive table—or drive tables—made up of received data

'distances.' Note that this map need not be two dimensional.) If graph weights represented as inter-point configuration distances satisfy appropriate metric and scale-type conditions, then these configuration distances can be interpreted as ratio-scale conversions of the received data. In general, admissibly transformed received data approximately corresponds to ratio-scale configuration distances. (Completing the drive table analogy, admissibly transformed drive table 'distances' can in some embodiments be interpreted as approximating ratio-scale intercity distances from an imperfectly reconstructed map of virtual cities.)

Applicant respectfully requests that the Examiner interview Applicant directly should there be any further clarification required. Such interview may be initiated by contacting the undersigned at (503) 220-8575.

In light of the above remarks, applicant respectfully requests reconsideration and withdrawal of the outstanding 35 USC Section 112 rejections as presented in the most-recent Office Action.

Respectfully submitted,

Keith A. Cushing
503 220 8575
Reg. No. 32,407

CERTIFICATE OF MAILING

I hereby certify that this paper (along with any paper referred to as being attached or enclosed) is being deposited with the US Postal Service as First Class Mail, in an envelope addressed to: Mail Stop Amendment, **Commissioner for Patents PO BOX 1450 Alexandria, VA 22313-1450, on the date indicated below.**

Date 1/03/07

Keith A. Cushing
Attorney of Record
Reg. No. 32,407